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South and Central American *Caenis* Species with Rounded Forceps Tips (Insecta: Ephemeroptera: Caenidae)

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With 10 figures

Summary

Five new *Caenis* **species** with apically rounded forceps from Argentina, Chile, Brazil and Panama are described. Redescriptions of two species described by L. NAVAS, *C. argentina* and *C. ludicra* places them in the same linage. According to morphological characters the lineage can be subdivided into 5 species-groups, among them one group from West Africa.

Zusammenfassung

Fünf neue *Caenis* **Arten** mit verrundeten Gonopodenspitzen von Argentinien, Chile, Brasilien und Panama werden beschrieben. Die Wiederbeschreibungen der beiden NAVAS'schen Arten *C. argentina* und *C. ludicra* erlaubt, sie ebenfalls in diese Linie einzuordnen. Anhand morphologischer Merkmale lässt sich die Linie in 5 Artengruppen unterteilen, eine westafrikanische Gruppe eingeschlossen.

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1. Introduction

The South American species of the ephemeropteran subfamily Caeninae known so far, can be divided into two lineages by the shape of the forcpes tip:

1. Species with apically pointed and strongly sclerotized forceps. Apart from the genus *Brasilocaenis* with a highly derived functional forceps-styliger-complex (MALZACHER, 1986, 1998) several *Caenis* species belong to this lineage: *Caenis cuniana* Froehlich, 1969 (a parthenogenetic species, the male of which was described 1993 by DA SILVA), *Caenis fittkaui* Malzacher, 1986, *Caenis candelata* Malzacher, 1986, *Caenis pseudamica* Malzacher, 1990 and *Caenis burmeisteri* Malzacher, 1990.

2. Species with weakly sclerotized and rounded forceps tips. This lineage has been represented up to now by the *Caenis* species of the *reissi*-group and the *pflugfelderi*-group: *Caenis reissi* Malzacher, 1986, *Caenis quatipuruica* Malzacher, 1986, *Caenis sigillata* Malzacher, 1986, *Caenis cigana* Pereira et al., 1990 and *Caenis pflugfelderi* Malzacher, 1990.

Some years ago I examined specimens of two species described by NAVAS (1915, 1920), *Caenis argentina* Navas, 1915 and *Caenis ludicra* Navas, 1920, in the Museum of Barcelona. I also got a number of samples collected in Argentina and Chile by Dr. E. DOMINGUEZ (Tucuman) and Dr. T. GONSER (Horw/Luzern), containing specimens very similar to those of the species described by NAVAS, all with rounded forceps-tips. On the basis of this material I am going to give redescriptions of the two species described by NAVAS which are placed both in the new *Caenis argentina*-group and descriptions of four new species which belong also to this group or are closely related to it. I also got a sample collected by Dr. H. MALICKY in Panama containing a new species of the *Caenis pflugfelderi*-group which will also be described in this paper.

I wish to thank the above mentioned colleagues for leaving me their material for study and Dr. O. ESCOLA from the Museum of Barcelona for allowing me access to specimens of the collection of L. NAVAS.

2. Redescriptions of two species described by L. NAVAS

2.1. *Caenis argentina* Navas, 1915

Material examined

Lectotype ♂ (micro-slide): Argentina, Buenos Aires Prov., Tandil, 7. I. 1983. (IML)[1]. – Paralectotypes: 19 ♂♂ and 20 larvae: Argentina, Buenos Aires Prov., Tandil, 7. I. 1983. – Further material: 1 ♀ and 2 larvae: Argentina, Buenos Aires Prov., Tandil, 7. III. 1983; – 2 ♂♂, 1 ♀ and 11 larvae: Argentina, Buenos Aires Prov., Tandil, 9. III. 1983; – 1 ♂ (subimago), 2 ♀♀ and 11 larvae: Argentina, Buenos Aires Prov., Sierra de la Ventana, 3. I. 1983. All specimens coll. DOMINGUEZ. – 1 ♂: Argentina, La Plata, 1914, coll. NAVAS (MZB)[2].

Note

In his description of *C. argentina* NAVAS didn't designate a holotype. All specimens on which his description are based, the only one in the MZB, too, are in bad

[1]) *IML* = Instituto Miguel Lillo, Universidad de Tucuman.
[2]) *MZB* = Museu de Zoologia, Barcelona.

condition, because they were taken from a spider web. Nevertheless the apically rounded forceps and the long lateral filaments are recognizable. Because of these characters in combination with the large size of the body, it is very probable that the specimen from the MZB and the males from Tandil belong to the same species. On the other hand other parts with diagnostic features (especially the fore legs) are lacking, and this specimen is therefore not suitable as type. Therefore I designate a lectotype out of the males from Tandil. It is prepared on a slide and labeled as follows: „ARGENTINA:/Buenos Aires prov./Tandil, 7. I. 1983/coll. Dominguez//*Caenis argentina*/Navas, 1915/LECTOTYPUS/det. Malzacher 1999."

Male

Body length: 4.0–4.7 mm; wing length: 3.8–4.0 mm; length of fore leg: 3.9–4.3 mm. Ratio of fore femur : fore tibia = 0.51–0.57; ratio of fore tibia : fore tarsus = 0.98–1.05; ratio of fore leg : hind leg = 2.06–2.20; ratio of first segment of the fore tarsus : 2^{nd} : 3^{rd} : 4^{th} : 5^{th} = 1 : 4.3–5.3 : 2.2–2.6 : 1.9–2.5 : 1.7–2.0.

Coloration of chitinous layers: Thorax brown, sutures and ridges darker, other parts pale yellowish-brown.

Epidermal pigmentation: Frons and vertex strongly pigmented, pale at the rear. Thorax with diffuse pigments. Abdominal tergites rather evenly pigmented, with clear paratergal marks. Sternites with median and paramedian spots. Middle and hind femora each with a preapical spot at the hind margin.

– In general aspect a species with a medium brown colour. –

Base of the antennal bristle hardly dilated (fig. 1i). Sclerotized prosternal triangle equilateral, pointed, and with more or less concave sides (fig. 1j). Lateral filaments of the abdominal segments rather long (fig. 1k). With a very long median fingerlike process on the second abdominal tergite (as in fig. 3k).

Genitalia and 9^{th} sternite as illustrated in fig. 1a. Central sclerite elongated, elliptical (figs. 1a–b). Styliger sclerite with long, straight apophyses. Forceps apically rounded, inner margin basally protruding, variable in shape (figs. 1 c–h). Epidermal pigments, if at all present, only developed in the frontal part of the 9^{th} sternite (fig. 1a, left side).

Female

Body length: 5.0–5.5 mm; wing length: 4.0–4.7 mm.

The coloration is very similar to that of the males.

Eggs

Chorion with very fine, often nearly invisible pores. Two large, cap-shaped epithemata with very small knobs. The micropyle is of medium length and a little widened at its open end.

Larva

Body length of mature nymph: ♂ 4.5–5.0 mm, ♀ 6.0–6.5 mm.

Coloration of chitinous layers: yellowish brown with pale blotches on the mesothorax and laterally on the abdominal tergites; often with a light longitudinal band in the middle of the head and pronotum; tibiae and tarsi with a brown band in the basal part.

Epidermal pigmentation: frontal part of the head, two paramedian spots and lateral marks on the pronotum and several dots on the mesonotum black pigmented.

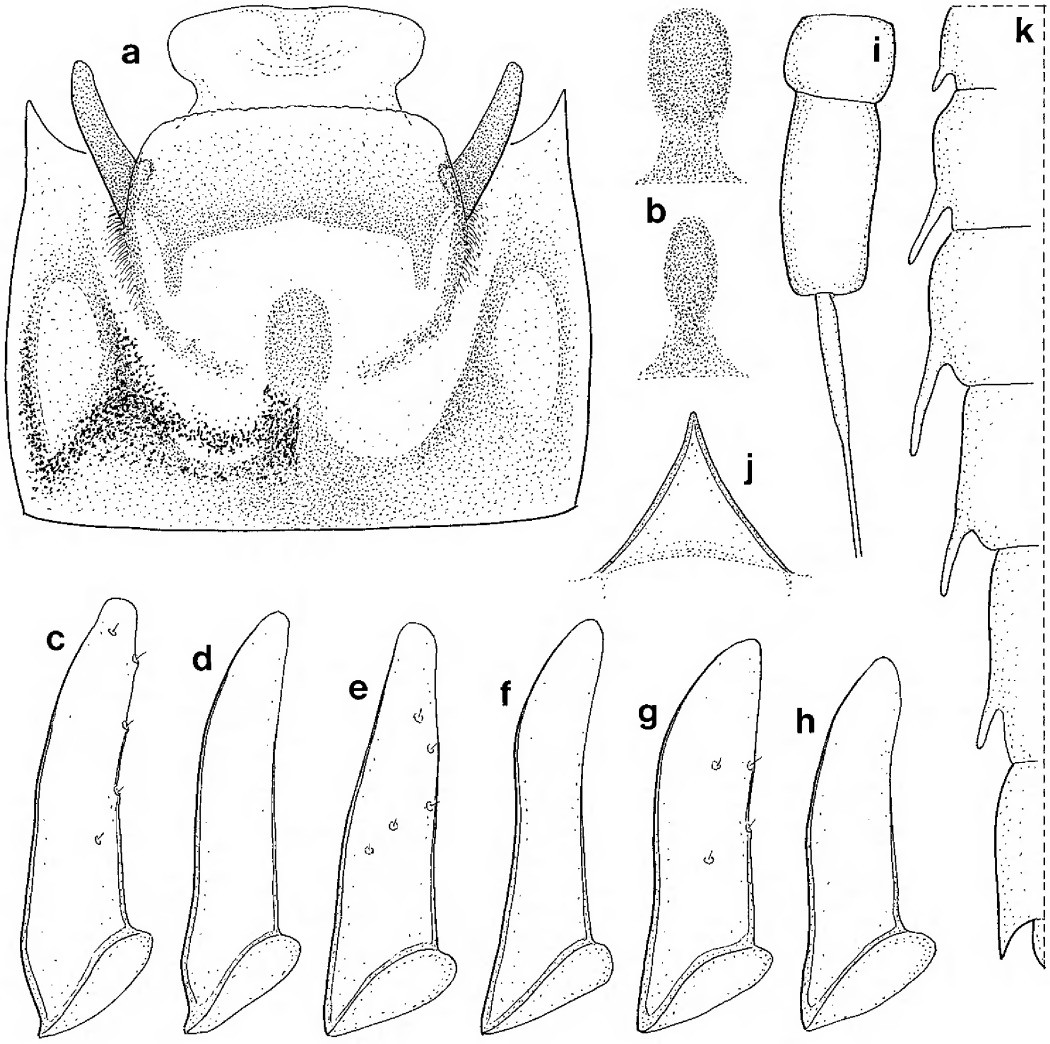

Fig. 1. *Caenis argentina* Navas; male. – a. Genitalia; – b. different shapes of central sclerite; – c–h. variability of forceps-shape: c, e and g with sensillae; – i. antenna: scape, pedicel and base of flagellum; – j. prosternal triangle; – k. outline of the lateral part of the abdomen with lateral filaments.

Large diffuse marks on each side of the abdominal tergites. 9th and 10th tergite with median black spots. Median and paramedian spots also on the sternites. Femora with preapical marks.

Body surface with fine frayed microtrichia (fig. 2i). Hind margin of the head with small frayed and long tapering bristles which are directed laterally (fig. 2c). Second segment of the labial palpus along the centre line 1.4–1.5 times the length of the third one. Sides of the pronotum as in fig. 2d. Sideparts of the mesonotum and wingbuds with long tapering bristles.

Coxal processes short, semicircular or sickleshaped. Transverse row of spines on the fore femur consisting of 6–9 apically frayed spines as in fig. 2h. Spines on middle and hind femora as those on the fore femur but a little weaker; large parts of these femora with short frayed bristles. Fore tarsus with one row, middle tarsus with one

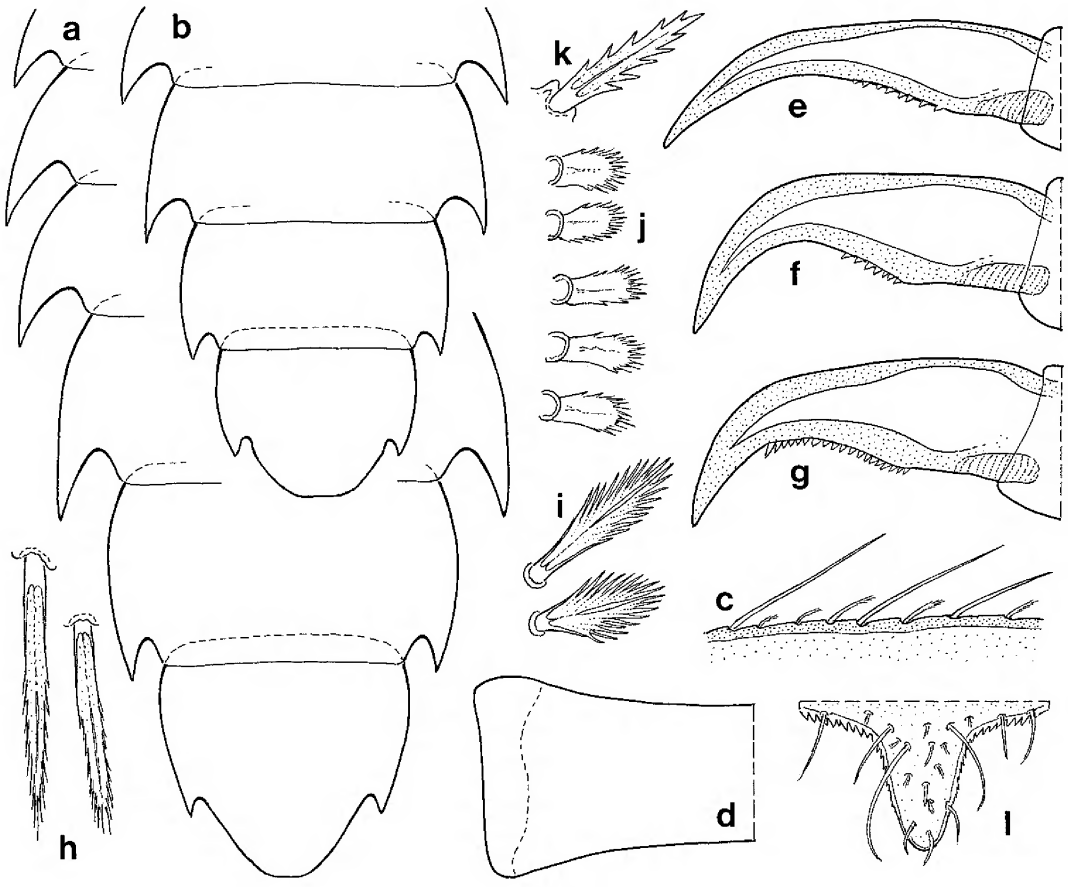

Fig. 2. *Caenis argentina* Navas; nymph. – a. Outline of female abdomen, shape of the 9th sternite; – b. outline of male abdomen, shape of the 9th sternite; – c. part of the hind margin of the head with laterally turned long bristles; – d. pronotum, left half; – e. claw of the fore leg; – f. claw of the middle leg; – g. claw of the hind leg; – h. spines from the row running across the fore femur; – i. frayed microtrichia from the body surface (mesonotum); – j. microtrichia from the underside of the second gill; – k. serrated spine from the hind tarsus; – l. posteriomedian process of the second abdominal tergite.

and a half or two rows of serrated spines (fig. 2k); following spines on the middle tibia daggershaped; hind tarsus with two rows of serrated spines, one of them with a few daggershaped ones; on the tibia with daggershaped and a few serrated spines. Claws of the tarsi as in figs. 2e–g.

Posteriomedian process of the second abdominal tergite long with rounded tip and long bent bristles (fig. 2l). Median ridge on the second gill with a few very long tapering bristles and shorter frayed ones; some long bristles also in a row parallel to the lateral margin. Microtrichia on the underside of the second gill as illustrated in fig. 2j. Hind margin of the tergites 7–10 as in most of the other species: 7 and 8 with long hair-like bristles, 9 and 10 with teeth; but the 10th tergite additionally with frayed bristles of different length which are bent to the middle. Outline of the abdomen as in fig. 2a and b, forming long and narrow lateral projections. 9th sternite caudally truncate, hind margin with strong bristles apically more or less abruptly bent to the

middle (*horaria*-type, as in fig. 7b; see MALZACHER, 1984: 16), shagreen field consisting of one or two rows of fine tubercles very close to the hind margin with scattered fine teeth in front.

2.2. *Caenis ludicra* Navas, 1920

Material examined

Lectotype ♂: Agentina, Cordoba Prov., Alta Gracia, 28. VIII. 1928, leg. BRUCH (MZB). – Paralectotypes 2 ♂♂: Argentina, Cordoba Prov., Alta Gracia, 28. VIII. 1928, leg. BRUCH (MZB). – Further material: 26 ♂♂: Argentina, Santiago del Estero Prov., Tucuman-Lules, 28. VIII. 1981, coll. DOMINGUEZ. – 7 ♂♂: Argentina, Cordoba Prov., San Esteban, 10. X. 1981, coll. DOMINGUEZ.

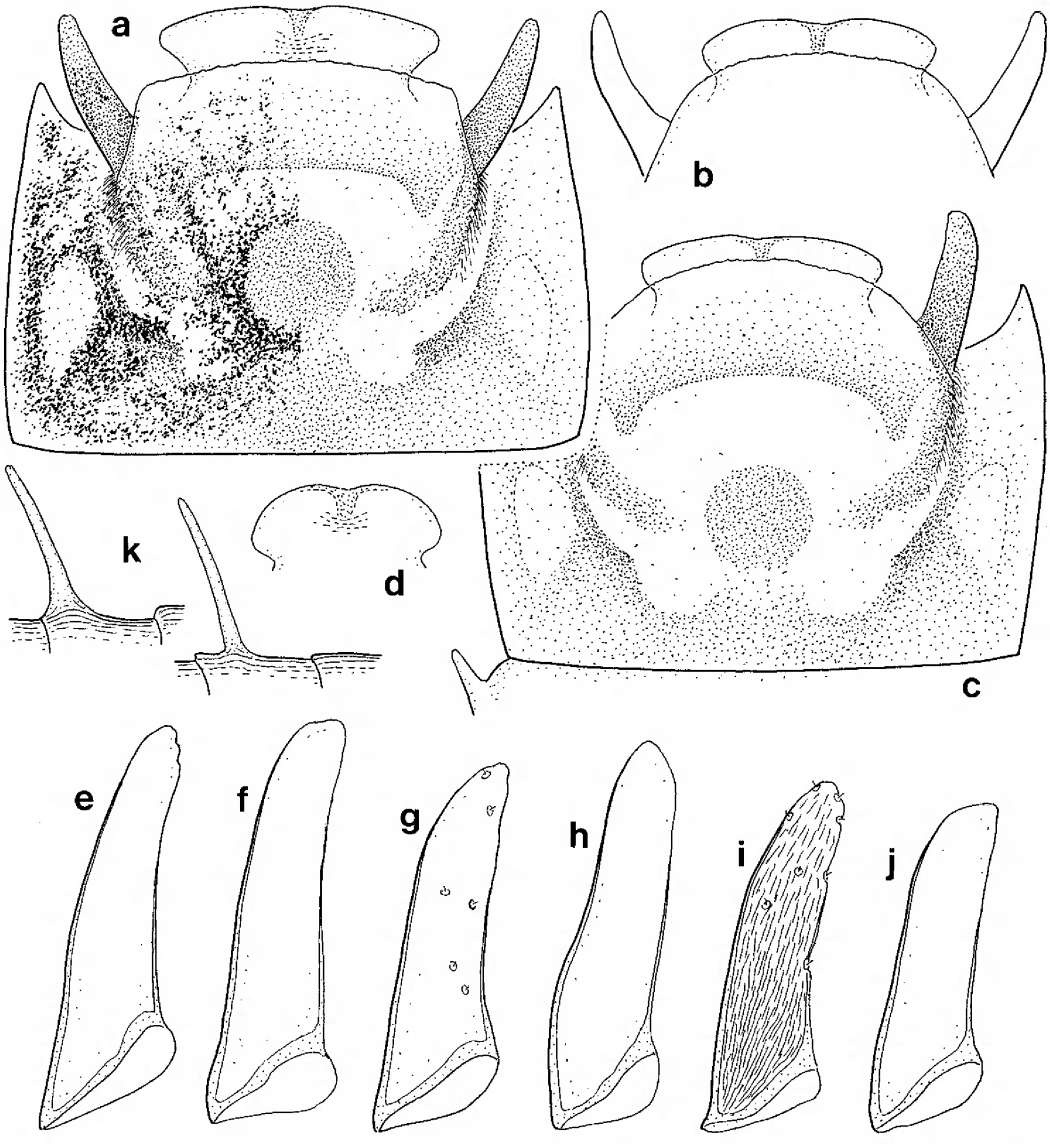

Fig. 3. *Caenis ludicra* Navas; male. – a, b and d. Genitalia: specimens from Tucuman, different shapes of penis and styliger-plate; – c. genitalia from a specimen from Alta Gracia (MZB); – e–j. variability of forceps-shape: g with sensillae, i with trichoma and sensillae; – k. fingerlike process on the second abdominal tergite.

Note

In *C. ludicra* no holotype was designated by L. NAVAS. A number of specimens in the MZB, which were determined as *C. ludicra,* collected in Alta Gracia and labeled as types but not mentioned in the paper concerned, were no Caenids at all but Leptohyphidae. I therefore choose the lectotype from another series of males, also collected in Alta Gracia, which are in fact *Caenis.* The dry specimen was transfered in glycerol and the genitalia prepared on a slide. The type is labeled: „Alta Gracia: Arg./C. Bruch ded. 1926//1. 7. 1926//*Caenis ludicra* Nav./P. Navas S. J. det." The slide is labeled: „ARGENTINA/Cordoba prov./Alta Gracia 1. VII. 1926//*Caenis ludicra*/Navas, 1920/LECTOTYPUS/det. Malzacher 2001."

Male

Body length: 2.6–2.8 mm (Alta Gracia), 3.0–3.8 mm (Tucuman); wing length: 3.0–3.2 mm (Alta Gracia), 3.6–4.0 mm (Tucuman); length of fore leg: 3.5–3.8 mm (Tucuman). Ratio of fore femur : fore tibia = 0.42–0.48; ratio of fore tibia : fore tarsus = 1.07–1.31; ratio of fore leg : hind leg = 2.12–2.35; ratio of first segment of the fore tarsus : 2^{nd} : 3^{rd} : 4^{th} : 5^{th} = 1 : 4.8–5.7 : 2.6–3.0 : 2.5–3.1 : 1.7–2.0.

Coloration of chitinous layers: Mesonotum and metanotum strongly brown. Head and pronotum a little paler. Abdomen yellowish brown.

Epidermal pigmentation: Head (dorsal side), prothorax, praealaria and abdomen (dorsal and ventral) strongly pigmented blackish brown. Pigments also on the sutures of meso- and metanotum, the wingbase and the coxae. Cerci with dark rings.

– In general aspect a dark or very dark coloured species. –

Base of the antennal bristle hardly dilated. Prosternal triangle frontally truncate. Lateral filaments of the abdominal segments of medium length, basally broadened; on average shorter than in *C. argentina* but in both species variable. Fingerlike process on the second abdominal tergite very long (fig. 3k).

Genitalia and 9^{th} sternite as illustrated in figs. 3a–c. Central sclerite circular. Styliger sclerite with short, rounded apophyses. Forceps of variable shape and length, ventral side basally strongly sclerotized (figs. 3e–j). Epidermal pigments distributed all over the 9^{th} sternite; sometimes even on the forceps (fig. 3a, left side).

Female

Unknown.

Larva of the *Caenis ludicra*-group

I've got some samples of larvae from different localities which are similar but not identical. Genitalia taken from mature male nymphs show characters of *C. ludicra* such as cirular central sclerite and strong pigmentation. The shape of the prosternal triangle also corresponds to this species. Larvae from the places where the males are found are lacking. The following description is based on the first sample mentioned under „Material". The specimens of the other samples differ a little especially in shape and arrangement of the bristles.

Material examined

65 larvae: Braziel, Santa Catarina State, River Herval, 27°10' S, 49°56' W, 340 m, IX. 1965, leg. PLAUMANN. – 3 larvae: Argentina, Cordoba Prov., San Esteban, 10. X. 1981, coll. DOMINGUEZ. – From different localities in Brazil: 11 larvae: Nova Teutonia, 27°11' S, 52°23' W, III. 1962; – 1 larva: Cruzeiro Brook, 28°19' S, 49°44' W, 1100 m, XII. 1962; – 2 larvae: Rio Irany, 26°55' S, 51°47' W, 600 m, IV. 1962; – 1 larva: Urubici River, 27°58' S, 49°34' W, 900 m;

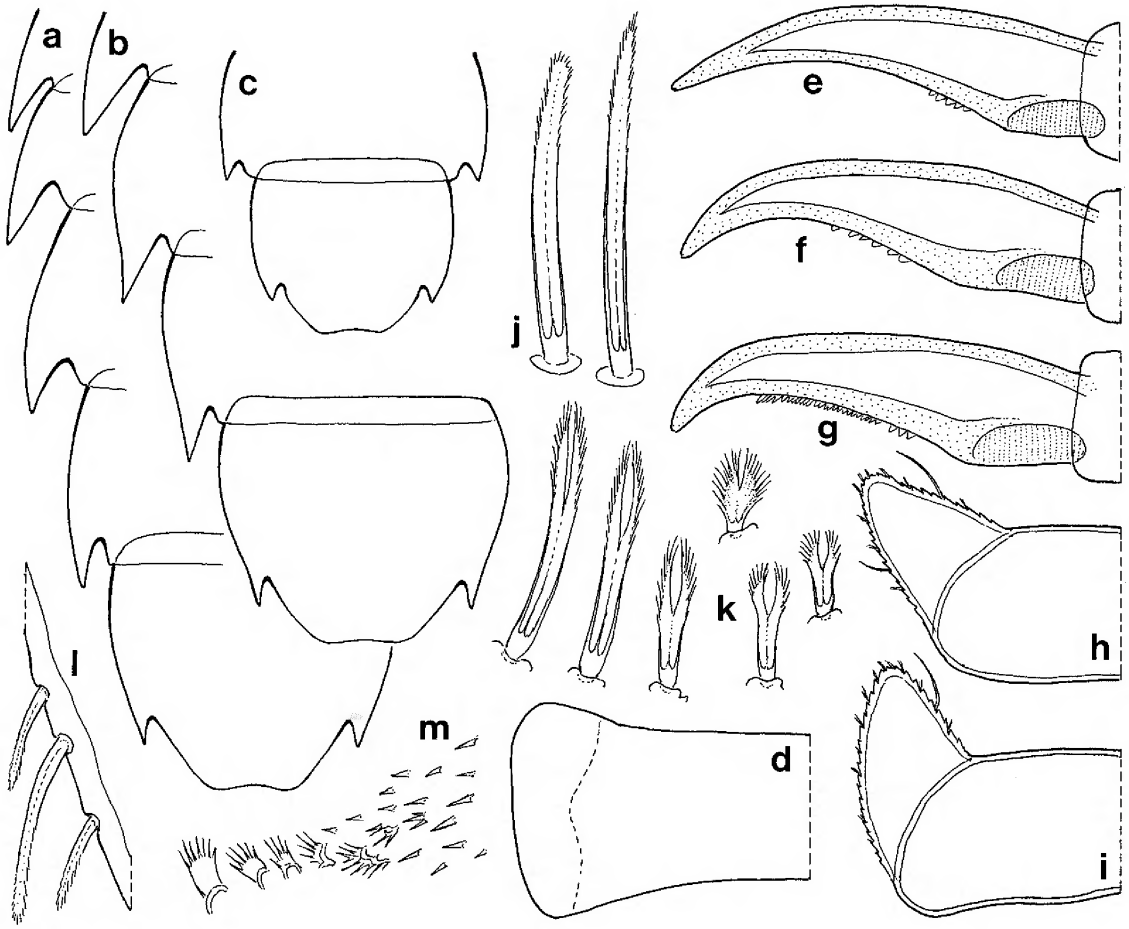

Fig. 4. *Caenis ludicra* Navas; nymph. – a, b. Outline of female abdomen, shape of the 9th sternite; – c. shape of the 9th sternite of a male nymph; – d. pronotum, left half; – e. claw of the fore leg; – f. claw of the middle leg; – g. claw of the hind leg; – h. coxal process from the hind leg; – i. coxal process from the middle leg; – j. spines from the margin of the fore tibia (right one) and middle and hind tibia (left one); – k. bifurcate spines from the femora (left), the second gill (right) and the mesonotum (above); – l. detail of the lateral margin of the 8th and 9th segment with blunt bristles; – m. proximal end of the row of microtrichia from the underside of the second gill.

– 1 larva: Aguas frias River, 27°42' S, 49°34' W, 600 m, XII. 1962. All specimens collected by F. Plaumann.

Description (larva)

Body length of mature nymph: ♂ 3.8–4.2 mm, ♀ 4.7–5.4 mm.

Coloration: Similar to *C. argentina;* the pale marks can be larger, the pigmentation sparser.

Body surface with strong frayed bifurcate bristles of very different length (fig. 4k). Hind margin of the head only with short bristles. Second segment of the labial

palpus along the median line about 1.7 times the length of the third. Sides of the pronotum slightly concave (fig. 4d).

Coxal processes long and apically more or less tapering (figs. 4h–i). Transverse row of spines on the fore femur consisting of about 10 apically frayed spines like the long spines in fig. 4k, which are a little stronger than those in *C. argentina.* Middle and hind femora with similar spines but scattered over the surface. Margines of femora and tibiae with long apically frayed spines as in fig. 4j. Fore tarsus with a single row, middle tarsus with one and a half or two rows and hind tarsus with two rows of daggershaped spines; in all rows apically a few serrated spines; spines which are following on the tibiae are daggershaped. Claws of the tarsi, as in figs. 4e-g; with shorter tips and weaker bent as in *C. argentina.*

Posteriomedian process of the second abdominal tergite long, mostly pointed, without long bristles. Surface of the second gill with strong frayed bifurcate bristles (fig. 4k, right from the letter k), on the median ridge very dense; without any long, tapering bristles. Hind margins of the tergites 7–10 as in most of the other species (7 and 8 with long hair-like bristles, 9 and 10 with teeth); hind margin of the 10th tergite additionally often with frayed bifurcate bristles. Outline of the abdomen as in figs. 4a–c. Lateral margins of the 9th (and sometimes the 8th) segment with relatively short, apically frayed and blunt bristles (fig. 4l) (in most of the other species with long tapering bristles). 9th sternite caudally truncate, hind margin slightly concave, arrangement of bristles corresponds with the *horaria*-type (as in fig. 7b; see MALZACHER, 1984: 17). Three irregular rows of small teeth forming a broad triangular shagreen field on this sternite.

3. Descriptions of new species

3.1. *Caenis dominguezi* spec. nov.

Material examined

Holotype ♂ (micro-slide): Argentina, Cordoba Prov., San Esteban, 10. X. 1981, coll. DOMINGUEZ (IML). – Paratypes: 10 ♂♂: Argentina, Cordoba Prov., San Esteban, 10. X. 1981 (IML and author's collection).

Male

Body length: 3,5–3,6 mm; wing length: 3,7–4,2 mm; length of fore leg: 3,4–3,8 mm. Ratio of fore femur : fore tibia = 0.38–0.45; ratio of fore tibia : fore tarsus = 1.48–1.56; ratio of fore leg : hind leg = 1.96–2.21; ratio of first segment of the fore tarsus : 2nd : 3rd : 4th : 5th = 1 : 3.9–4.6 : 2.2.–2.4 : 1.7–2.0 : 1.4–1.8.

Coloration of chitinous layers: Thorax strongly reddish-brown; scutellum and metanotum particularly dark; abdomen, legs and base of antenna yellowish-brown.

Epidermal pigmentation: Frontal part of the head rather strongly pigmented. Pronotum with two transverse bands, one on the fore margin and another one, slightly curved, in the middle, and with two paramedian spots. Abdominal tergites evenly and sparsely pigmented. Paratergal marks hardly visible or lacking.

– In general aspect a species with a medium brown colour and a dark brown thorax. –

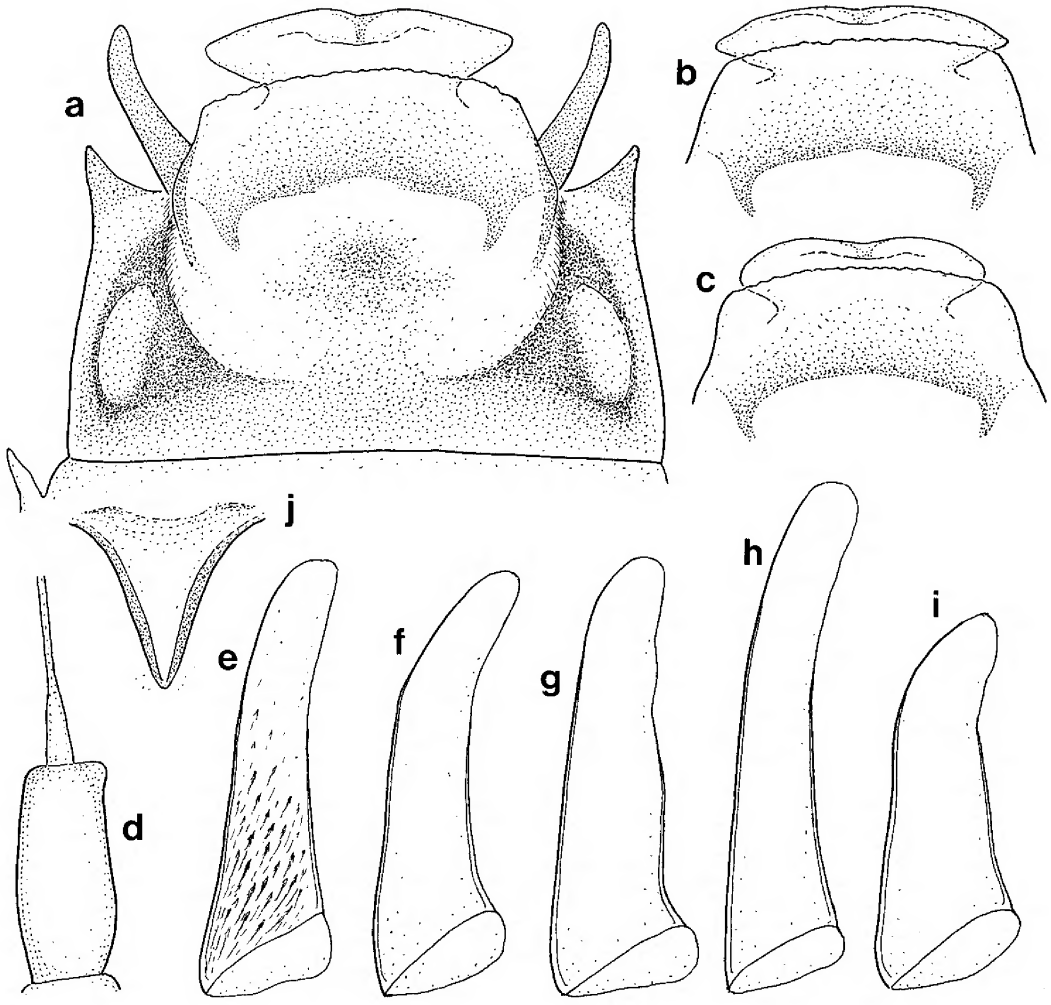

Fig. 5. *Caenis dominguezi* spec. nov.; male. – a. Genitalia; – b, c. different penis-shapes; – d. antenna: scape, pedicel and base of flagellum; – e–i. variability of forceps-shape: e with trichoma; – j. prosternal triangle.

Base of the antennal bristle a little dilated, length of the pedicel about 2.5 times the length of the dilated part (fig. 5d). Prosternal triangle with concave sides, frontally pointed or open (fig. 5j). Lateral filaments of the abdomen about as long as in *C. ludicra;* filaments of the 7th and 8th segment often shorter. Fingerlike process on the second abdominal tergite long.

Genitalia and 9th sternite as illustrated (figs. 5a–c). Lateral chitinous structures strongly coloured. Penis with long, pointed, sometimes rounded lobes. Apophyses of the styliger sclerite bent inwards. Central sclerite with blurred outline. Forceps as in figs. 5e–i; shape and length very variable, e and f most common. Basal half with trichomae with arrowhead-shaped dilated tips (fig. 5e).

Female and larval stages

Unknown.

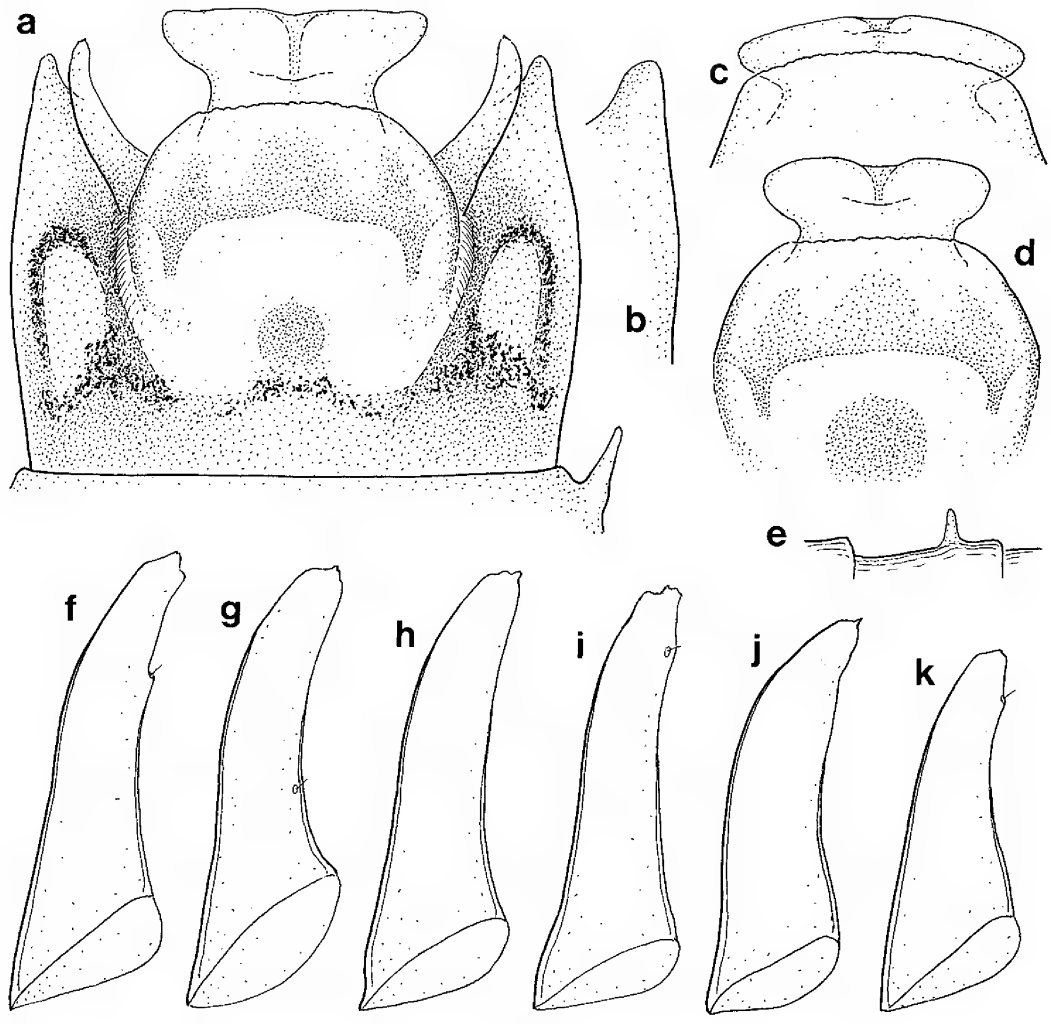

Fig. 6. *Caenis gonseri* spec. nov.; male. – a. Genitalia; – b. another shape of the caudolateral process; – c, d. different penis-shapes; – e. fingerlike process on the second abdominal tergite; – f–k. variability of forceps-shape.

3.2. *Caenis gonseri* **spec. nov.**

Material examined

Holotype ♂ (micro-slide): Chile, Rio Choapa, 13. VI. 1986; leg. GONSER (BMNH)[3]. – Paratypes: 53 ♂♂: Chile, Rio Choapa, 13. VI. 1986; leg. GONSER (author's collection). – Further Material: 3 ♂♂: Argentina, Rio Negro Prov., El Chocon, est. Carrizo, 1. IV. 84, coll. KAISINI.

Male

Body length: 2.8–3.8 mm; wing length: 3.2–3.8 mm; length of fore leg: 2.8–3.5 mm. Ratio of fore femur : fore tibia = 0.42–0.50; ratio of fore tibia : fore tarsus = 1.16–1.37; ratio of fore leg : hind leg = 1.90–2.18; ratio of first segment of the

[3]) *BMNH* = Natural History Museum, London [formerly British Museum (Natural History)].

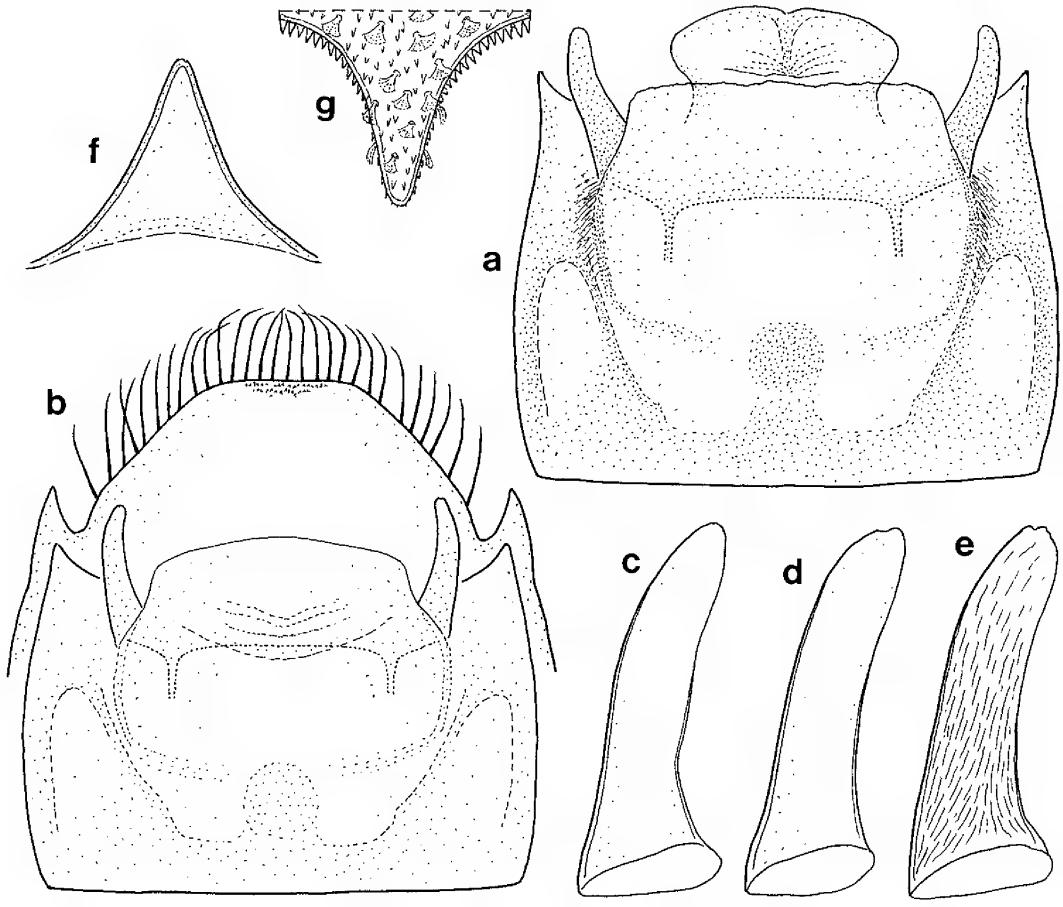

Fig. 7. *Caenis plaumanni* spec. nov. – a. Male genitalia; – b. hind part of the 9th sternite of a mature male nymph with subimaginal genitalia and shagreen-field; – c–e. male: variability of forceps-shape; – f. male: prosternal triangle; – g. nymph: posteriomedian process of the second abdominal tergite.

fore tarsus : 2nd : 3rd : 4th : 5th = 4.1–5.0 : 2.3–2.6 : 1.9–2.4 : 1.3–1.7. Ratio of body length : length of cercus : length of terminal filament = 1 : ± 3.3 : ± 4.0.

Coloration of chitinous layers: Thorax strongly yellowish brown, other parts more or less lighter.

Epidermal pigmentation: Head, pronotum and abdominal tergites rather evenly pigmented. Segments 7–9 with long, basally broadened paratergal marks.

– In general aspect a species with a medium yellowish-brown colour. –

Base of the antennal bristle hardly dilated. Prosternal triangle equilateral, with straight or concave sides, tip rounded or more or less broadly blunt. Lateral filaments of the abdomen as in *C. dominguezi* (7 and 8 short). Fingerlike process on the 2nd tergite short (fig. 6e).

Genitalia and 9th sternite as illustrated in figs. 6a–d. Penis anvilshaped or with rounded lobes, with a narrow shaft (fig. 6a) but variable (figs. 6c–d). Styliger sclerite with long apophyses, sometimes bent inwards. Central sclerite circular, with very

different diameter. Forceps as in figs. 6f–k, curved and basally braodened, tip with small projections (f–h are the most common shapes). Caudolateral processes of the 9th sternite more or less broadly rounded (fig. 6b).

Female and larval stages

Unknown.

3.3. *Caenis plaumanni* **spec. nov.**

Material examined

Holotype ♂ (micro-slide): Brazil, Rio Grande do Sul Prov., Passo da Guarda, 30°18' S, 56°00' W, 180 m, XI. 64, leg. PLAUMANN (BMNH). – Paratpyes: 2 ♂♂: Brazil, Rio Grande do Sul Prov., Passo da Guarda, 30°18' S, 56°00' W, 180 m, XI. 64, leg. PLAUMANN (author's collection). – Further material: 16 larvae: Brazil, Rio Grande do Sul Prov., Passo da Guarda, 30°18' S, 56°00' W, 180 m, XI. 64, leg. PLAUMANN. – 1 ♂: Brazil: Rio Grande do Sul Prov., Arroio Irapua, 30°19' S, 53°13' W, 150 m, XI. 64, leg. PLAUMANN. – 4 larvae: Brasil: Rio Grande do Sul Prov., Arroio Inhandul, 29°52' S, 56°03' W, IX. 64, leg. PLAUMANN.. – 5 larvae: Brasil, Nova Teutonia, 27°11' S, 52°23' W, III. 62, leg. PLAUMANN.

Male

Body length: 2.7–2.8 mm; wing length: 2.8–3.0 mm; length of fore leg: 2.9–3.0 mm. Ratio of fore femur : fore tibia = 0.45–0.51; ratio of fore tibia : fore tarsus = 1.03–1.14; ratio of fore leg : hind leg = 2.09–2.34; ratio of first segment of the fore tarsus : 2nd : 3rd : 4th : 5th = 1 : 5.3–6.7 : 1.8–2.7 : 1.8–2.7 : 1.6–2.0.

Coloration of chitinous layers: Meso- and metathorax coffee-coloured; other parts yellowish or yellowish-brown.

Epidermal pigmentation: Dorsal side of the head strongly pigmented; pigments also on the base of the labial rudiments and the antennae. Pronotum a little paler, with two paramedian dark spots, abdomen only weakly pigmented.

In general aspect a species with a medium yellowish-brown colour.

Base of the antennal bristle hardly dilated. Prosternal triangle equilateral or a little elongated, frontally pointed or rounded (fig. 7f). Lateral filaments of the abdomen very short. Fingerlike process on the second abdominal tergite long.

Genitalia and 9th sternite as illustrated in fig. 7a. Penis lobes rather short and rounded. Apophyses of the styliger sclerite long and very thin and more away from the base of the forceps as in the other species described in this paper. Forceps as in figs. 7c–e.

Female

Unknown.

Larvae

Body length of mature nymph: ♂ about 3.5 mm, ♀ 3.8–5.0 mm.

Coloration: Similar to *C. argentina,* the pigmentation is sparser.

The body surface is densely covered with strong teeth and chracteristic scaleshaped microtrichia (figs. 8i–j). Hind margin of the head without long bristles, but with microtrichia only. Second segment of the labial palpus along the centre line 1.5 times the length of the third. Sides of the pronotum straight, with broadly rounded fore corners, sometimes slightly converging to the front (fig. 8e). Coxal processes semicircular, margin with strong, blunt teeth and a few microtrichia (fig. 8k). Transverse row of spines on the fore femur consisting of only 3–5 short, apically frayed and blunt spines.

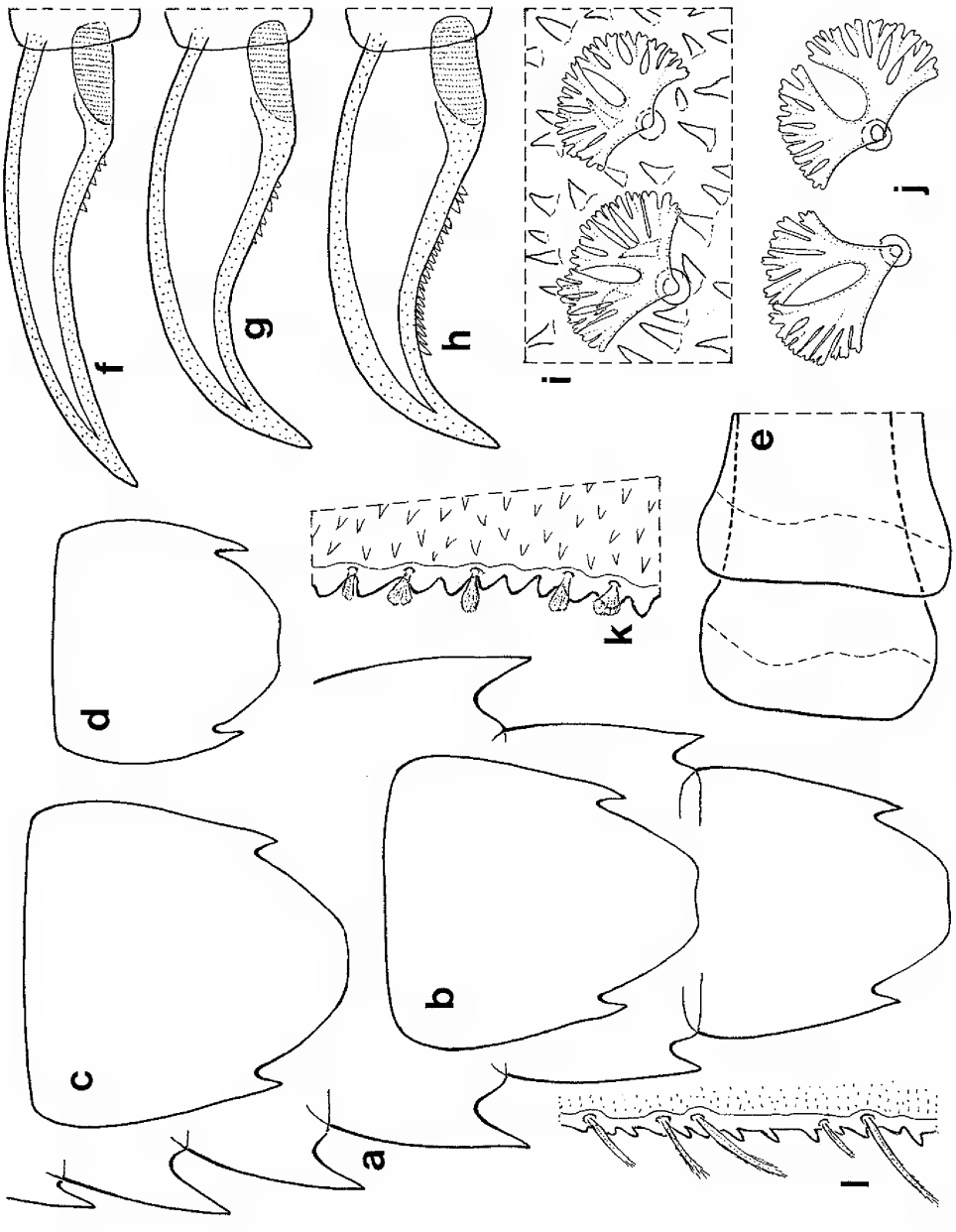

Fig. 8. *Caenis plaumanni* spec. nov.; nymph. – a. Outline of female abdomen, shape of the 9th sternite; – b, c. female: other shapes of the 9th sternite; – d. shape of the 9th sternite of a male nymph; – e. pronotum, left part; – f. claw of the fore leg; – g. claw of the middle leg; – h. claw of the hing leg; – i, j. scaleshaped microtrichia; – k. detail of the lateral margin of the pronotum; – l. detail of the lateral margin of the 9th sternite.

Surface of the middle and hind femora covered with scaleshaped microtrichia (fig. 8i); what seems to are short spines on the margins are scaleshaped microtrichia, too, seen from the side. Fore tarsus with one row, middle tarsus with one to two and hind tarsus with two rows of strongly serrated spines; most of the following spines on the tibiae serrated. Claws of the tarsi similar to those of *C. argentina;* microteeth on the hind claws more numerous, the basal teeth clearly stronger (figs. 8f–h).

Posteriomedian process of the second abdominal tergite long and pointed, with scaleshaped microtrichia (fig. 7g). Surface of the second gills densely covered with scaleshaped microtrichia; median ridge basally with a few pointed spines. Microtrichia on the underside of the second gill similar to those of *C. argentina,* mostly a little more elongated and with straight sides. Hind margin of the 8th tergite only in the median part with long bristles, the lateral parts with teeth; other hind margins as usual but with additionally scaleshaped microtrichia. Outline of the abdomen as in fig. 8a. Lateral margins of the 8th and 9th segments with blunt and frayed bristles, most of them are very short. Adjacent to the bristles there are small teeth. 9th sternite elongated, especially in female nymphs; caudally truncate and mostly a little concave (figs. 8b–d). Arrangement of bristles corresponds with the *horaria*-type (as in fig. 7b; see MALZACHER, 1984: 16); shagreen field consists of one or two irregular rows of small teeth near the hind margin (fig. 7b).

3.4. *Caenis grimi* **spec. nov.**

Material examined

Holotype ♂ (micro-slide): Argentina, Buenos Aires Prov., Laguna Jema, Formosa, 11. XI. 85; coll. DOMINGUEZ (IML). – Paratypes: 43 ♂♂ and 66 ♀♀: Argentina, Buenos Aires Prov., Laguna Jema, Formosa, 11. XI. 85 (IML and author's collection). – Further material: 3 ♂♂ and 4 ♀♀: Argentina, Buenos Aires, Delta.

Male

Body length: 1.9–2.6 mm; wing length: 1.7–2.2 mm; length of fore leg: 1.6–1.9 mm. Ratio of femur : fore tibia = 0.70–0.84; ratio of fore tibia : fore tarsus = 0.86–1.02; ratio of fore leg : hind leg = 1.42–1.62; ratio of first segment of the fore tarsus : 2nd : 3rd : 4th : 5th = 1 : 2.7–3.3 : 1.6–2.0 : 1.7–2.1 : 1.3–1.7. Ratio of body length : length of cercus : length of terminal filament = 1 : ± 2.2 : ± 3.4.

Coloration of chitinous layers weak: Mesothorax light brown, other parts pale yellowish brown or yellow. Anteriolateral parts of the mesopleura reddish-brown.

Epidermal pigmentation, medium or weak: Frontal part of the frons and two transverse bands on the vertex. Pronotum with a transverse band on the fore margin, and another, broader one, in the hind part, often flowing together in the middle, forming a median field with two black spots. The sutures of the mesonotum are sparsely pigmented. Metanotum with a median black spot. Abdominal tergites 1 and 2 with narrow, sometimes interrupted transverse bands, the others with paralateral blotches, becoming weaker to the rear. Paratergal marks lacking. Spots and marks on the coxae and the pleura. The whole fore legs pigmented.

– In general aspect a pale coloured species. The black eyes contrast strongly to the pale body. –

Base of the antennal bristle hardly dilated. Prosternal triangle broad with rounded tip and straight or slightly concave sides. Lateral filaments of the abdominal segments very short.

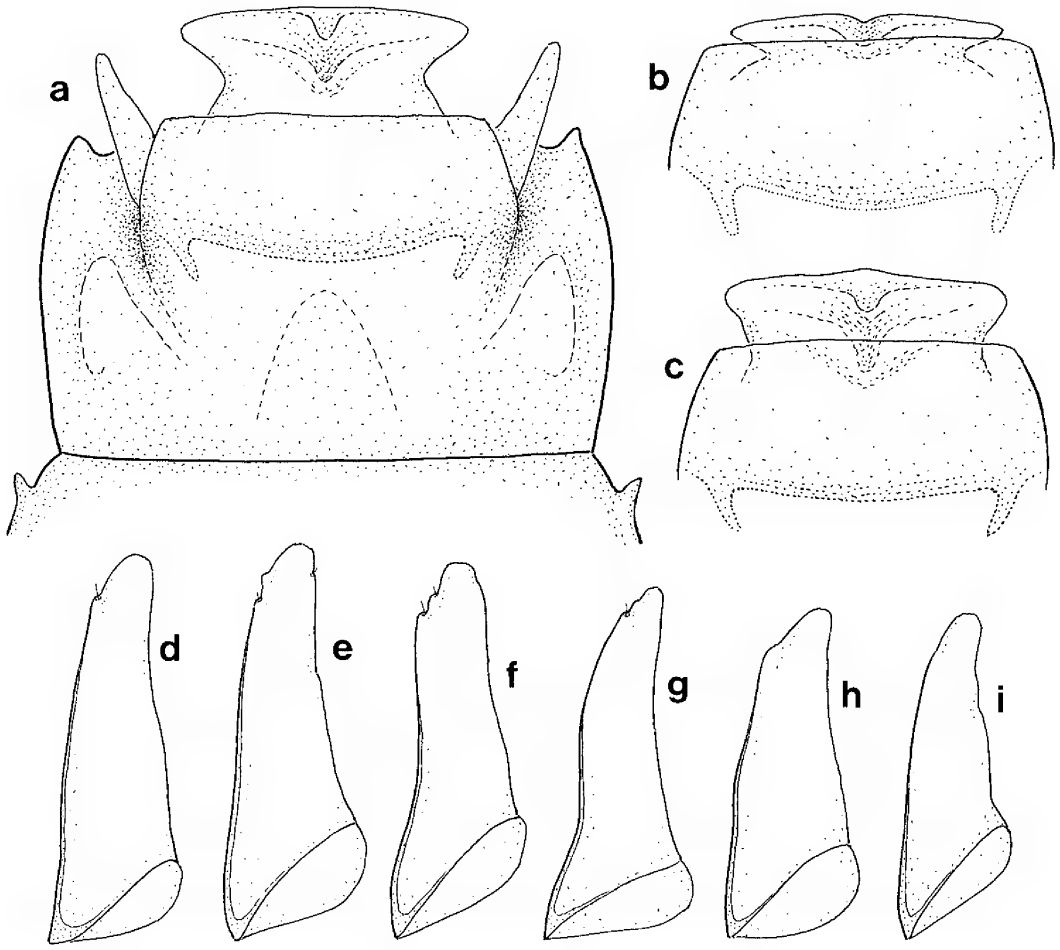

Fig. 9. *Caenis grimi* spec. nov.; male. – a. Genitalia; – b, c. different penis-shapes; – d–i. variability of forceps-shape.

Genitalia and 9th sternite as illustrated in figs. 9a–c. Penis in normal position, anvilshaped with triangular lobes. Styliger sclerite broad with concave fore margin, apophyses bent inwards. Forceps short and tapering (figs. 9d–i, d and e are the most common shapes). Surface with very fine trichoma, lateroapical with 1 or 2 sensillae.

Female

Body length: 3.0–3.7 mm; wing length: 2.4–2.8 mm.

The coloration is very similar to that of the males. Pigmentation a little stronger.

Tergites 1–6 with broad transversal bands, sometimes interrupted in the middle.

Prosternal triangle usually broader than in the males. Lateral processes short and triangular.

Eggs

Surface of the chorion with a fine and dense granulation. Two flat epithemata, medially a little more voluminous, with rather large, round terminal knobs. With one long micropyle laying in the equatorial plane.

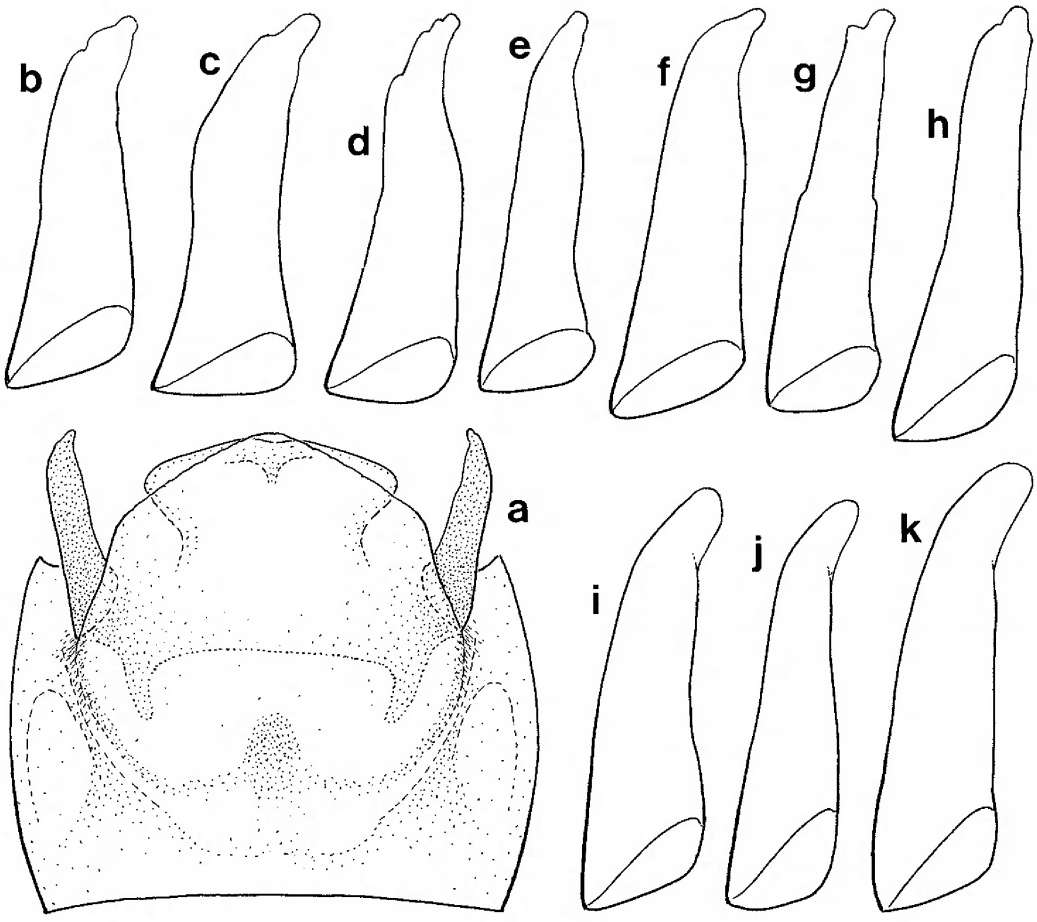

Fig. 10. *Caenis panamensis* spec. nov.; male. – a. Genitalia; – b–h. variability of forceps-shape. – *Caenis pflugfelderi* Malzacher; male. – i–k. Variability of forceps-shape.

Larval stages

Unknown.

3.5. *Caenis panamensis* spec. nov.

Material

Holotype ♂ (micro-slide): Panama, Barro Colorado Isand, II./III. 1986, leg. MALICKY (BMNH). – Paratypes: 39 ♂♂ and 47 ♀♀ (most of them are subimagines): Panama, Barro Colorado Isand, II./III. 1986, leg. MALICKY (author's collection).

Male

Body length: 2.0–2.3 mm; wing length: 1.7–2.0 mm. Ratio of fore femur : fore tibia = 0.75–0.83; ratio of fore tibia : fore tarsus = 1.10–1.18; ratio of fore leg : hind leg = 1.41–1.47.

Coloration: Because of the bad condition of the specimens the coloration cannot be described. The epidermal pigmentation seems to be similar to that of *C. pflugfelderi* (see MALZACHER 1990).

Base of the antennal bristle weakly dilated. Prosternal triangle broad, frontally blunt or open. Lateral filaments of the abdominal segments short.

Genitalia and 9th sternite as illustrated in fig. 10a. Penis lobes triangular with rounded tips. Styliger sclerite with strong apophyses often a little bent. Forceps as in figs. 10b–h, very variable. The tip is stepped narrowed often forming an apical knob unlike in the closely related *Caenis pflugfelderi* where the tip is broadly rounded (figs. 10i–k).

Female

Body length: 2.8–4.0 mm; wing length: 2.5–3.5 mm.

Eggs

Chorion clearly but not very densly pored, a honeycomb-structure like in *C. pflugfelderi* is lacking. With two flat epithemata and one micropyle of medium length lying in the equatorial plane and flanked by two rows of pores.

Larval stages

Unknown.

4. Species groups

The hitherto known *Caenis* species with apically rounded forceps may be subdivided into 5 species-groups, 4 of them occuring in South and Central America, one in West Africa. They can be distinguished by the following characters:

1. The *elouardi*-group, represented by *Caenis elouardi* from Guinea.
Male genitalia with reduced, weak and uncoloured sclerites which are hardly recognizable; penis with rounded lobes; forceps short, straight, sparsely covered with soft trichoma; distance between the extreme lateral points of the forceps bases 3.0–3.5 the forceps-length. Lateral filaments of the abdomen lacking. Fore tibia a little longer than the fore femur. Fore leg $1^1/_4$ to $1^1/_3$ the length of the hind leg.

2. The *reissi*-group, represented by *Caenis reissi, C. quatipuruica, C. sigillata* and *C. cigana,* all from the eastern and central Amazon region.
Male genitalia with reduced, weak and uncoloured sclerites, often hardly recognizable; penis broad and undifferentiated, lobes very short or lacking; forceps short or very short, apically broadly rounded, densely covered with trichoma a little sticking out from the surface; distance between the extreme lateral points of the forceps bases 2.2–2.8 the forceps-length. Lateral filaments of the abdomen very short or lacking. Fore tibia about $1^1/_3$ to $1^1/_2$ the length of the femur and a little shorter as the tarsus. Fore leg 1.7–1.8 the length of the hind leg.

3. The *pflugfelderi*-group, represented by *Caenis pflugfelderi* from the central Amazon region and *C. panamensis* from Panama.
Male genitalia a little more differentiated than in the *reissi*-group; sclerites weakly coloured; penis with rounded or triangular lobes; hind part of the styliger-plate more or less triangular; forceps longer, apically narrowed or tapering; distance between the extreme lateral points of the forceps bases 1.6–1.9 the forceps-length. Lateral filaments of the abdomen short or very short. Fore tibia about $1^1/_4$ to $1^1/_3$ the length of the femur and as long as the tarsus. Fore leg 1.3–1.4 the length of the hind leg.

4. The *grimi*-group, represented by *Caenis grimi* from the river-mouth-region of the Rio de la Plata (Argentina and Uruguay).
Penis more or less anvilshaped; lobes clearly separated and pointed, styliger-plate broad with straight hind margin; fore margin of the styliger sclerite convex; apophyses thin and bent inwards; forceps short and apically tapering; distance between the extreme lateral points of the forceps bases 2.3–2.6 the forceps-length; all parts uncoloured. Lateral filaments of the abdomen very short. Fore tibia about $1^1/_4$ to $1^1/_3$ the length of the femur, a little shorter than or as long as the tarsus. Fore leg about $1^1/_2$ the length of the hind leg.

5. The *argentina*-group, represented by *Caenis argentina* (Argentina, Prov. Buenos Aires), *C. ludicra* (distributed in Argentina and southern Brasil), *C. dominguezi* from Argentina, Prov. Cordoba, *C. gonseri* from Middle Chile and Argentina, Prov. Rio Negro and *C. plaumanni* from Brasil, Prov. Rio Grande do Sul.
Genital sclerites and forceps coloured; penis with rounded or pointed lobes; forceps of middle length, at least the basal half densely covered with trichoma lying flat on the surface; distance between the extreme lateral points of the forceps bases 1.8–2.5 the forceps-length. Lateral filaments of the abdomen middle or long. 2nd abdominal tergite with a fingerlike process. Fore tibia about twice as long as the femur, as long or longer than the tarsus. Fore leg twice as long as the hind leg or longer (!).

Each of the species-groups 2 and 5 contains a species that differ a little from the other ones. *C. cigana* has well developed round penis-lobes as in the figure in Pereira & Da Silva (1990) but the other features characterize it as a species of the *reissi*-group. The same applies to the *argentina*-group where *C. plaumanni* shows only short lateral filaments on the abdomen. All other species of the group have medium or long filaments.

Within a group the diagnostic features of the species can be variable, e.g. a population of *C. gonseri* from Eastern Argentina shows central sclerites with blurred outline similar to those of *C. dominguezi.* On the other hand I got a single specimen of the latter species with rounded caudolateral processes on the 9th sternite like in *C. gonseri.* Only the knowledge of a large material from different localities of the distribution area can decide from case to case the question if two or more members of a species-group are species of their own or if they form something like a circle of races with intermediate forms, flowing into each other.

I discussed the relationships between the South American and the West African *Caenis* species with simple and apically rounded forceps. This allows conclusions regarding origin, development and distribution of the family (see Malzacher 1991: 76–77).

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